

### **REMARKS**

Claims 1-22 are pending and under consideration in the above-identified application.

In an Office Action dated April 1, 2009, the Examiner rejected claims 1-22.

With this Amendment, claims 1, 6-7, 11-15, 17-18, and 20-21 are amended and claim 8 is cancelled. No new matter has been introduced as a result of this amendment.

#### **I. Specification**

The specification was amended to correct for spelling errors. No new matter has been introduced as a result of the amendment.

#### **II. 35 U.S.C. § 102 Anticipation Rejection of Claims**

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Tsutsui et al. (JP 2003-264085). The rejection is traversed.

In relevant part, the amended claim recites (emphasis added):

. . . said charge generation layer is composed of a complex oxide comprising at least one alkali metal or alkaline earth metal . . .

By way of an example, on page 17 of the present application, the complex oxide in the charge generation layer 15-0 can be composed of an alkali metal or alkaline earth metal and an oxide selected from the metaborates, tetraborates, germanates, molybdates, niobates, silicates, tantalates, titanates, vanadates, tungstates, zirconates, carbonates, oxalates, chromites, chromates, dichromates, ferates, selenites, selenates, stannates, tellurites, tellurates, or bismuthates.

Tsutsui et al. teaches a multilayered semiconductor element that contains a conductive film layer that uses *only* a simple metal oxide film. Tsutsui et al. paragraph [103-104]. Tsutsui et al. fails to teach the use of a complex alkali or alkaline earth metal oxide in the charge generation layer.

The choice of a complex metal oxide provides the benefit of having a stable component in the charge generation layer 15-0 without having to consider the stoichiometric ratio during fabrication. Tsutsui et al. nowhere recognizes this.

Accordingly, independent claim 1 is patentable over the cited reference. Applicant respectfully requests that the above rejection be withdrawn.

### **III. 35 U.S.C. § 103 Obviousness Rejection of Claims**

#### **1. 35 U.S.C § 103(a) Obviousness Rejection of Claims 7-8**

Claims 7 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui et al. (JP 2003-264085). The rejection is traversed.

In relevant part, claim 7 recites (emphasis added):

. . . an interfacial layer on a cathode side of said charge generation layer that is composed of an organic material having a phthalocyanine skeleton.

This means the interfacial layer is on the cathode side of the charge generation layer 15-0 and acts as an intermediate anode layer. See Page 20, Lines 18-23. This intermediate anode layer enhances the efficiency of the hole injection from the charge generation layer 15-0 into the light-emitting unit 14-1. See Page 24, Lines 20-25.

Tsutsui et al. teaches that an organic compound can be used as *the conductor thin film layer*. Tsutsui et al. paragraph [105]. Tsutsui et al. also teaches that metal phthalocyanines and non-metal phthalocyanines are mixed together to form a p-type organic semiconductor and n-type organic semiconductor as the organic compound in the thin metal film layer. Tsutsui et al. paragraph [106].

As such, Tsutsui et al. fails to teach or fairly even suggest (1) the use of an interfacial layer in the charge generation layer or (2) that phthalocyanine can be used in the interfacial layer

and not in the charge generation layer to enhance the efficiency of the hole injection from the charge generation layer into a light-emitting unit.

Applicant respectfully requests that the rejection be withdrawn.

**2. 35 U.S.C § 103(a) Obviousness Rejection of Claims 2-6**

Claims 2-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui (JP2003-264085) and Arai et al. (U.S. Patent 6,340,537). The rejection is traversed.

Each of claim 2-6 requires, in one way or another, the charge generation layer to include  $\text{Li}_2\text{SiO}_3$ . The cited art fails to fairly suggest this.

In contrast, and acknowledged in the office action, Tsutsui et al. teaches the use of a *metal oxide* as the thin conductive layer. Tsutsui et al. paragraphs [103-104].

Arai et al. teaches the use of a hole injecting layer 4 between the anode 2 and the light emitting layer 5. Arai et al. [column 6 lines 20-25]. Specifically, Arai et al. primarily directs the person skilled in the art toward using tin-doped indium oxide (ITO), zinc-doped indium oxide (IZO), indium oxide ( $\text{In}_2\text{O}_3$ ), tin oxide ( $\text{SnO}_2$ ), zinc oxide ( $\text{ZnO}$ ), or silicon oxide ( $\text{SiO}_2$ ) in the hole injecting layer 4. Arai et al. [column 6 lines 57-67]. Arai et al. only mentions the use of a silicate in the hole injecting layer 4 in passing. Arai et al. [column 2 lines 21-24]. Arai et al. specifically teaches that the location of the “metal and/or its oxide, carbide, nitride, silicate, and boride” be located between the anode 2 and light emitting layer 5. Arai et al. [column 2 lines 21-24]. Arai et al. clearly does not teach the use of lithium silicate in the charge generation layer.

Nothing in either Arai et al. or Tsutsui et al. suggests or motivates (1) the specific use of lithium silicate and (2) that the use of lithium silicate in the charge generation layer between two light emitting units would improve the brightness and lifetime of the device. Neither Arai et al. nor Tsutsui et al. nor their combination fairly suggests or motivates the use of lithium silicate in

the charge generation layer between light-emitting units to improve upon the efficiency, environmental stability, or ease of fabrication.

Applicant respectfully requests that the rejection be withdrawn.

**3. 35 U.S.C § 103(a) Obviousness Rejection of Claims 9-10**

Claims 9 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui (JP 2003-264085) and Ishiskawa et al. (U.S. Patent 6,492,041). The rejection is traversed.

In relevant part, claims 9 and 10 recite (emphasis added):

(Claim 9) . . . said charge generation layer comprises an organic compound represented by the following formula (1).

(Claim 10) . . . said metal oxide in said charge generation layer forms an interfacial layer on an anode side of said charge generation layer, and said organic compound forms an intrinsic charge generation layer.

This means that the compound represented by formula (1) is located within the charge generation layer and is located between the light emitting units. Additionally, in claim 10, two distinct layers are formed in the charge generation layer: the metal oxide layer and the intrinsic charge generation layer. See e.g. Figure 2 of the present application.

Tsutsui et al. teaches *only* the use of either a metal oxide *or* an organic compound as the thin conductive layer. Tsutsui et al. paragraphs [103-104]. Tsutsui et al. specifically suggests a mixed p-type organic semiconductor and n-type organic semiconductor. Tsutsui et al. paragraphs [105, 106, and 108].

Ishiskawa et al. teaches a triphenylene compound used in the *light emitting layer 4, the electron transport layer 5, or the hole injection layer 3*. Ishiskawa et al. [column 21 lines 16-20].

The Examiner suggests that one skilled in the art would readily move a triphenylene compound from within a light emitting unit to the charge generation layer, and that a multi-layered charge generation layer would be used to improve efficiency of the display device. Applicant respectfully disagrees.

Tsutsui et al. does not teach or suggest the use of the compound described by formula (1) in the charge generation layer. In fact, Tsutsui et al. suggests only the use of a *mixed* p-type and n-type organic semiconductor layer to be used as the charge generation layer. Ishiskawa et al. does not teach or suggest (1) the substitution of nitrogen for positions X<sup>1-6</sup> in the compound described by formula (1) or (2) the use of the compound described by formula (1) in a charge generation layer *between* light emitting units. Additionally, neither Tsutsui et al. nor Ishiskawa teach or suggest a charge generation layer composed of an interfacial alkali or alkaline earth metal oxide layer and an intrinsic charge generation layer formed by the compound described by formula (1).

Ishiskawa et al. also limits the location of the triphenylene compound to within a light emitting unit. Even with knowledge of multi-stacked organic EL devices, Ishiskawa et al. did not suggest or even recommend the use of the triphenylene compound as a separate layer between the light emitting units 14-1 and 14-2. Ishiskawa et al. [column 21 lines 1-3]. Claim 9, however, requires the organic compound described by formula (1) to be used in the charge generation layer 15 *between* the light emitting units (14-1 and 14-2) and not in the layers within the light emitting units. Additionally, although Tsutsui et al. describes the use of an organic compound as the thin conductive layer, Tsutsui et al. specifically suggests using a mixed organic composition of a p-type organic semiconductor and a n-type organic semiconductor. Nothing in Tsutsui et al.

suggests that the compound described in formula (1) can be used alone in the charge generation layer 15.

Applicant respectfully requests that the rejection be withdrawn.

**4. 35 U.S.C § 103(a) Obviousness Rejection of Claims 11-13**

Claims 11-13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui (JP2003-264085) and Ueda et al. (U.S. Patent 6,180,217). The rejection is traversed.

Each of claims 11-13 require, in one way or another, the charge generation layer to include an interfacial layer of an alkali or alkaline earth metal fluoride on the anode side of the charge generation layer. The cited art fails to fairly suggest this.

Tsutsui et al. teaches *only* the use of either a metal oxide *or* an organic compound as the thin conductive layer. Tsutsui et al. paragraphs [103-104].

Ueda et al. teaches the use of a *mixed layer* of an electron transporting material and a metal fluoride for the electron injection layer 7. Ueda et al. [column 31 lines 44-51].

The Examiner states that the motivation to use a metal fluoride layer is to create a hole transporting layer with high ionization potential to improve the efficiency. Applicant respectfully disagrees.

Neither Ueda et al. nor Tsutsui et al. nor in combination teach or suggest the use of a metal fluoride layer in the charge generation layer. Accordingly, independent claim 11 is patentable over the cited references. Additionally, all dependent claims are also patentable over the cited reference for at least the same reasons.

Applicant respectfully requests that the rejection be withdrawn.

**5. 35 U.S.C § 103(a) Obviousness Rejection of Claims 14-15, 18, and 20-22**

Claims 14-15, 18, and 20-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui (JP2003-264085) and Ueda et al. (U.S. Patent 6,180,217) as applied to claim 11 above. The rejection is traversed.

In relevant part, claim 14 recites (emphasis added):

. . . a second interfacial layer on a cathode side of said charge generation layer  
that is composed of an organic material having a phthalocyanine skeleton.

By way of an example, Figure 3 of the present application shows the layers between light emitting units 14-1 and 14-2 to include (1) a first interfacial layer 15a' on the anode side of the charge generation layer 15' composed of a fluoride and an alkali metal or alkaline earth metal, (2) an intrinsic charge generation layer 15b, and (3) a second interfacial layer (not shown in figure) on the cathode side of the charge generation layer 15' composed of an organic material having a phthalocyanine skeleton.

Tsutsui et al. teaches that an organic compound can be used as *the* conductor thin film layer. Tsutsui et al. paragraph [105]. Tsutsui et al. also teaches that metal phthalocyanines and non-metal phthalocyanines can be mixed together to form a p-type organic semiconductor and n-type organic semiconductor as the thin metal film layer. Tsutsui et al. paragraph [106].

Tsutsui et al. fails to teach or fairly even suggest (1) the use of an interfacial layer *with* a charge generation layer; (2) that phthalocyanine can be used in the interfacial layer and not in the charge generation layer to enhance the efficiency of the hole injection from the charge generation layer into the next light-emitting unit; and (3) the multi-layered charge generation layer having a first interfacial layer of metal fluoride on the anode side, an intrinsic charge generation layer, and

a second interfacial layer of an organic compound having a phthalocyanine skeleton on the cathode side of the charge generation layer.

Applicant respectfully requests that the rejection be withdrawn.

Each of claim 18 and 20-22 require, in one way or another, the charge generation layer to include a mixed layer of at least one element of alkali metals or alkaline earth metals and an organic material, and an intrinsic charge generation layer in contact with each other on the anode side of the charge generation layer. The cited art fails to fairly suggest this.

By way of an example, in Figure 4 of the present application, the charge generation layer 15'' is shown to be divided into two layers: (1) a mixed alkali or alkaline earth metal and organic material layer 15a'' and (2) an intrinsic charge generation layer 15b.

In contrast, and as acknowledged in the office action, Tsutsui et al. teaches *only* the use of either a metal oxide *or* an organic compound as the thin conductive layer. Tsutsui et al. paragraphs [103-104].

Ueda et al. teaches the use of a mixed layer of an electron transporting material and a metal fluoride for the *electron injection layer* 7. Ueda et al. [column 31 lines 44-51].

The Examiner states that a person skilled in the art would readily vary the position of the mixed layer in Ueda et al. to locate it in the thin conductive layer location in Tsutsui et al. Applicant respectfully disagrees.

Neither Ueda et al. nor Tsutsui et al. nor in combination teach or suggest the use of a mixed alkali or alkaline earth metal oxide and organic compound layer 15a'' combined with an intrinsic charge generation layer 15b located in the charge generation layer 15''. Accordingly, independent claim 18 is patentable over the cited references. Additionally, all dependent claims are also patentable over the cited reference for at least the same reasons.



Applicant respectfully requests that the rejection be withdrawn.

**6. 35 U.S.C § 103(a) Obviousness Rejection of Claims 16-17 and 19.**

Claims 16-17 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutsui (JP2003-264085) and Ueda et al. (U.S. Patent 6,180,217) as applied to claim 11 above, and further in view of Ishikawa et al. (U.S. Patent 6,492,041). The rejection is traversed.

In relevant part, claims 16-17 and 19 recite (emphasis added):

(Claim 16) . . . according to claim 11, wherein said charge generation layer comprises an organic compound represented by the following formula (1)

(Claim 17) . . . said interfacial layer is formed of a layer comprising:  
a fluoride comprising at least one alkali metal or alkaline earth metal; and  
a conducting material layer, arranged in this order from the side of said anode

(Claim 19) . . . according to claim 18, wherein said charge generation layer comprises an organic compound represented by the following formula (1)

Tsutsui et al. teaches *only* the use of either a metal oxide *or* an organic compound as the thin conductive layer. Tsutsui et al. paragraphs [103-104].

Ueda et al. teaches the use of a mixed layer of an electron transporting material and a metal fluoride for the *electron injection layer* 7. Ueda et al. [column 31 lines 44-51]

Ishikawa et al. teaches a triphenylene compound in the light emitting layer 4, the electron transport layer 5, or the hole injection layer 3. Ishikawa et al. [column 21 lines 16-20].

The Examiner suggests that one skilled in the art would relocate the metal fluoride layer to form an interfacial layer in the charge generation layer *and* use a triphenylene compound from Ishikawa et al. in the intrinsic charge generation layer to improve the efficiency and stability of the display device. Applicant respectfully disagrees.

Tsutsui et al. does not teach or suggest the use of an additional interfacial layer of fluoride in a charge generation layer *or* even a multi-layered charge generation layer. Ueda et al. does not suggest that the metal fluoride layer could be used between two *complete* light emitting units in a charge generation layer. Even with knowledge of multi-stacked organic electroluminescent devices, Ishikawa et al. did not suggest or even recommend the use of a triphenylene compound layer between the light emitting units 14-1 and 14-2. Ishikawa et al. [column 21 lines 1-3].

Tsutsui et al., Ueda et al., and Ishikawa et al. alone, or in combination, do not teach or fairly suggest (1) that the use of the compound represented by formula (1) *outside of the layers in a light emitting unit* or (2) that the interfacial layer on the anode side of the charge generation layer can be composed of both an alkali or alkaline earth metal fluoride layer *and* a conducting material layer.

Applicant respectfully requests that the rejection be withdrawn.

#### IV. Conclusion

In view of the above amendments and remarks, Applicant submits that all claims are clearly allowable over the cited prior art, and respectfully requests early and favorable notification to that effect.

Respectfully submitted,

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